

# PATENT ABSTRACTS OF JAPAN

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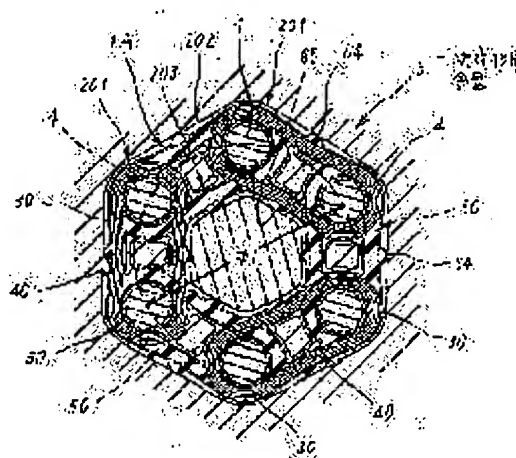
## (54) METHOD OF MANUFACTURING FLEXIBLE COUPLING

### (57)Abstract:

PROBLEM TO BE SOLVED: To provide a flexible coupling having excellent durability and capable of satisfying both the buffering property and the vibration absorbing property and the torque transmitting force in the case where a torsion displacement is small.

SOLUTION: An even number of connector link 30 are arranged in the circumferential direction with the predetermined space, and the adjacent connector links 30 and 30 in the circumferential direction are connected to each other in the circumferential direction by a first and a second connecting belts 40 and 50 wrapped in a loop, and set in a primary molding 3, and the first and the second connecting belts 40 and 50 are coated with an elastic inner layer part so as to form a primary mold 1A.

In the primary mold 1A, a pitch 1 of the connector links 30 and 30 is set smaller than a pitch of the connector links 30 and 30 in the primary molding, and the primary mold 1A is set in a secondary molding 5 in the condition that looseness is given to the first and the second connecting belts between each connector link 30 and 30 by projecting parts 64 and 65, and the periphery of the primary mold 1A is formed with an elastic outer layer at the predetermined thickness.



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CLAIMS

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[Claim(s)]

[Claim 1] Said connector link (30 30) which arranges even connector links (30) at intervals of circumferencial direction predetermined, and adjoins a circumferencial direction Connect alternately with a circumferencial direction with the first and second connection band (40 50) almost rolled in the shape of a loop formation, and it sets in a primary molding die (3). The primary Plastic solid (1A) which covered said first and the second connection band (40 50) with the elastic body inner layer section (60A) is fabricated. Where slack is given to said first and the second connection band (40 50) between said each connector link (30 30) through said elastic body inner layer section (60A) The manufacture approach of the flexible coupling characterized by setting said primary Plastic solid (1A) in the metal mold for secondary forming (5), and fabricating the elastic body outer layer section of necessary thickness on the periphery of this primary Plastic solid (1A).

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DETAILED DESCRIPTION

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[Detailed Description of the Invention]

[0001]

[Field of the Invention] This invention relates to the manufacture approach of the flexible coupling which connects elastically between the axis ends of a driving-side revolving shaft and a follower side revolving shaft.

[0002] As this kind of a flexible coupling, two or more driving-side connector links and a follower side connector link are arranged alternately with a circumferential direction, the driving-side connector link which adjoins a circumferential direction, and a follower side connector link are connected with the connection band around which fiber was almost wound in the shape of a loop formation where it has slack to some extent, and there are some which these connector links and a connection band made the structure laid under the rubber. And the typical conventional technique is indicated by JP,62-292924,A or the patent official report No. 2773348.

[0003] While the above-mentioned flexible coupling is attached in the axis end of a driving-side revolving shaft by circumferential direction regular intervals, each driving-side connector link It is that to which each follower side connector link is attached in the axis end of a follower side revolving shaft by circumferential direction regular intervals, and performs the power transfer from a driving side to a follower side. Until the slack of a connection band is canceled between a driving-side connector link and a follower side connector link at the time of the input of running torque If the absorption effectiveness which was excellent since it twisted and rigidity was maintained small is demonstrated and said connection band is extended in the shape of a straight line, since it will twist and rigidity will become high, it has the two-step property of demonstrating the big torque-transmission force.

[0004]

[Problem(s) to be Solved by the Invention] However, if slack is given to a connection band between an adjacent driving-side connector link and a follower side connector link in order to twist and to form a property into a two-step property, the fiber consistency of said connection band will vary at the time of shaping of rubber, or it will be easy to produce a difference of the amount of slack by restoration of the molding material into metal mold at it. For this reason, it becomes impossible for each connection band to share an input torque with homogeneity, an input torque becomes excessive with some connection bands, and there is a possibility that endurance may fall.

[0005] Moreover, since the insertion member for giving slack is needed for the connection band according to the above-mentioned conventional technique, since said insertion member touches said connection band, components mark not only increase, but wear of a connection band is promoted by friction and there is a possibility of resulting at an early stage at breakage. And if it twists by the torque input and an angle becomes large, that it is easy to separate from said insertion member from a connection band, it will become or a possibility that a crack may arise to rubber around this insertion member will also be pointed out.

[0006] The place which this invention was made in view of the above problems, and is made into the main technical technical problem satisfies the absorption nature and buffer nature at the time of the

initial input of torque, and the both sides of the torque-transmission force, and is to offer the flexible coupling excellent in endurance.

[0007]

[Means for Solving the Problem] In order to solve effectively the technical technical problem mentioned above, the manufacture approach of the flexible coupling concerning this invention Arrange even connector links at intervals of circumferencial direction predetermined, and connect said connector link which adjoins a circumferencial direction alternately with a circumferencial direction with the first and second connection band almost rolled in the shape of a loop formation, and it is set in a primary molding die. Where it fabricated the primary Plastic solid which covered said first and the second connection band with the elastic body inner layer section and slack is given to said first and the second connection band between said each connector link through said elastic body inner layer section said primary Plastic solid -- secondary forming -- public funds -- it sets in a mold and the elastic body outer layer section of necessary thickness is fabricated on the periphery of this primary Plastic solid.

[0008]

[Embodiment of the Invention] Drawing 1 thru/or drawing 3 show the gestalt of desirable implementation of the manufacture approach of the flexible coupling concerning this invention. In addition, in the following explanation, a "circumferencial direction" is the direction of the periphery centering on the axial center of a flexible coupling.

[0009] The flexible coupling which serves as a candidate for manufacture in this manufacture approach has structure as shown in drawing 5 . Namely, this flexible coupling 1 The driving-side connection child 10 stationed at intervals of [ three ] 120 degrees of circumferencial directions and this driving-side connection child 10 are phases different 60 degrees. The follower side connection child 20 stationed at intervals of [ three ] 120 degrees of circumferencial directions, and the connector link 30 with which each [ these ] connection children's 10 and 20 periphery was equipped, The first and second connection bands 40 and 50 almost rolled alternately with a circumferencial direction ranging over the connector link 30 of the periphery of the driving-side connection child 10 who adjoins a circumferencial direction, and the connector link 30 of the follower side connection child's 20 periphery, It has the elastic body 60 which said each connector link 30 and each connection bands 40 and 50 will be covered from the elastomer by which vulcanization shaping was carried out.

[0010] The driving-side connection child 10 and the follower side connection child 20 are stationed so that it may consist of a cylinder-like metal member and the axial center may become the axial center of the flexible coupling 1 concerned, and parallel. Moreover, a connector link 30 consists of metal colors 32 and 33 of the pair of the cross-section abbreviation U typeface by which said driving-side connection child 10 or the follower side connection child 20 was fixed to the peripheral face of the metal sleeve 31 by which press fit attachment is carried out, and its shaft-orientations both ends, as shown in drawing 2 .

[0011] The first and second connection bands 40 and 50 wind the wire rods 41 and 51 which consist of polymeric materials which have necessary \*\*\*\* elasticity, such as polyester, in the shape of a multilayer, as shown in drawing 2 . And the first connection band 40 is almost rolled in the shape of a loop formation ranging over the part between the colors 32 and 33 in the periphery of the sleeve 31 of the connector link 30 with which the follower side connection child 20 who adjoins a part, and said driving-side connection child 10 and circumferencial direction between the colors 32 and 33 in the periphery of the sleeve 31 of the connector link 30 with which the driving-side connection child 10 was equipped was equipped among these. Moreover, the second connection band 50 is almost rolled in the shape of a loop formation ranging over the inside of the color 32 in the connector link 30 with which the driving-side connection child 10 who adjoins said follower side connection child 20 and circumferencial direction in the color 32 of the connector link 30 with which the follower side connection child 20 was equipped, and 33 was equipped, and 33.

[0012] That is, each driving-side connection child 10 and each follower side connection child 20 of each other are stationed by turns at intervals of 60 degrees, and are connected alternately with a circumferencial direction with connector links 30 and 30, the first connection band 40 of -- almost rolled

in the shaft-orientations middle, and said connector links 30 and 30 and the second connection band 50 of -- almost rolled near the shaft-orientations both ends.

[0013] The elastic body 60 is fabricated so that the perimeter of the first of connector links 30 and 30 and -- prolonged in a perimeter and the meantime and the second connection bands 40 and 50 may be wrapped in. Between the base 61 of Rokkasho which is surrounding the periphery side of each connector link 30, and said bases 61 and 61 which adjoin a circumferencial direction is extended in the shape of a straight line in detail, and it consists of a periphery which is surrounding the perimeter of the first connection band 40 or the second connection band 50, and the inner circumference Division for Interlibrary Services 62 and 63, and has become window part 60a between these, respectively.

[0014] Moreover, the first and second connection bands 40 and 50 are the interior of the periphery Division for Interlibrary Services 62 in an elastic body 60, and the inner circumference Division for Interlibrary Services 63, and are prolonged in the configuration which slackened so that it might be unevenly distributed to the window part 60a side. Namely, the distance L1 of the interstitial segment of the first connection band 40 passing through the inside of the periphery Division for Interlibrary Services 62, and the interstitial segment of the first connection band 40 passing through the inside of the inner circumference Division for Interlibrary Services 63 The interstitial segment of the second connection band 50 which is smaller than the diameter d1 (refer to drawing 2 ) of the first connection band volume of the sleeve 31 in a connector link 30, and passes along the inside of the periphery Division for Interlibrary Services 62 similarly, The distance L2 with the interstitial segment of the second connection band 50 passing through the inside of the inner circumference Division for Interlibrary Services 63 is smaller than the diameter d2 (refer to drawing 2 ) of the second connection band volume of the colors 32 and 33 in a connector link 30.

[0015] The flexible coupling 1 equipped with the above-mentioned configuration is attached in York of the axis end of a follower side revolving shaft which counters with the axis end of said driving-side revolving shaft with the bolt (illustration abbreviation) which each follower side connection child 20 inserted in each at intervals of 120 degrees of circumferencial directions, while each driving-side connection child 10 is attached in York of the axis end of a driving-side revolving shaft at intervals of 120 degrees of circumferencial directions with the bolt (illustration abbreviation) inserted in each. While transmitting rotation of a driving-side revolving shaft to a follower side revolving shaft through the first connection band 40 or the second connection band 50 by this, with the deformation property of said first and the second connection bands 40 and 50, and an elastic body 60, rotation transfer in the condition that the directions of the axial center of a driving-side revolving shaft and a follower side revolving shaft differ is permitted, and vibration is absorbed among said both shafts.

[0016] In detail, if a driving-side revolving shaft and a follower side revolving shaft twist relatively and displace by the input of torque, in the part in which the driving-side connection child 10 and the follower side connection child 20 are estranged relatively, the first connection band 40 or the second connection band 50 will be extended from a connector link 30 and the slack configuration between 30. And a process until the first connection band 40 or the second connection band 50 is extended in the shape of a straight line, in order that the inner circumference Division for Interlibrary Services 63 may receive bending deformation elastically in the bore direction, the periphery Division for Interlibrary Services 62 of the elastic body 60 united with this demonstrates suitable twist spring nature in the outer-diameter direction, and does so an effective buffer function and an absorption function by this to it.

[0017] Moreover, when [ of a driving-side revolving shaft and a follower side revolving shaft ] it twists and the amount of displacement becomes larger than predetermined If the slack of the first connection band 40 in the part in which the driving-side connection child 10 and the follower side connection child 20 are estranged relatively, or the second connection band 50 was canceled and it will be completely extended in the shape of a straight line From this time, a twist spring constant increases with the \*\*\*\* elasticity of said first connection band 40 or the second connection band 50. for this reason, excessive [ between the driving-side connection child 10 and the follower side connection child 20 ] -- it twists, a variation rate is controlled and positive torque transmission is performed.

[0018] Drawing 6 shows the characteristic ray Fig. which measured the twist spring property about the

flexible coupling 1 shown in drawing 5 . It becomes the low absorption field alpha of a twist spring constant, and it twists rather than it and the twist spring constant serves as the high torque-transmission field beta in the field where an include angle is large until the first connection band 40 or the second connection band 50 is extended in the shape of a straight line so that clearly from this drawing. On the other hand, as the flexible coupling of the structure which does not have slack in the connection bands 40 and 50 is shown in drawing 7 , it twists, and the first stage to a twist spring constant is high, and the remarkable absorption field alpha does not exist. Said absorption field alpha can be expressed with a degree type.

[Equation 1]

$$\alpha \cong \left( \frac{\phi 2 - \phi 1}{\phi 1} \right) \times 2^\circ$$

The connector links [ in / here / the phi1; flexible coupling 1 ] 30 and 30, the pitch of -- (refer to drawing 5 )

phi 2; the connector links 30 and 30 at the time of primary shaping mentioned later, the pitch of -- (refer to drawing 1 )

[0019] Moreover, since the insertion member for giving slack to the first and second connection bands 40 and 50 does not exist in this flexible coupling 1, components mark do not increase but neither wear of the first by friction with said member and the second connection bands 40 and 50 nor the crack initiation of an elastic body 60 which twists and originates in said insertion member at the time of increase of an angle must have been produced.

[0020] The flexible coupling 1 of the above-mentioned configuration can be manufactured by the approach described below.

[0021] First, as shown in drawing 1 , extrapolation immobilization of connector links 30 and 30 and -- is carried out, respectively, and the first connection band 40 and the second connection band 50 are almost wound around the connector links 30 and 30 and -- which adjoin each other at a circumferential direction by turns at the fixed shafts 2 and 2 and -- which have been arranged at intervals of the phase of 60 degrees on the periphery of a pitch phi 2. In addition, the pitch phi 2 is greatly set up a little rather than the connector links 30 and 30 in the flexible coupling 1 as a product of said fixed shafts 2 and 2 and -- shown in drawing 5 , and the pitch phi 1 of -- (the driving-side connection child 10 and follower side connection child 20). Moreover, as shown in drawing 2 explained previously, the first connection band 40 is almost wound around the part between the colors 32 and 33 in a connector link 30, and the second connection band 50 is almost wound around the colors 32 and 33 of both sides.

[0022] Next, in the above-mentioned condition, after building the union object of the first and second connection bands 40 and 50 into the shaping space of the primary molding die 3 with connector links 30 and 30 and --, it is filled up with an elastomer molding material and vulcanization shaping is carried out. Since it is almost wound where predetermined tension is given between the connector link 30 which said first connection band 40 and the second connection band 50 adjoin at this time, and 30, by restoration of the elastomer molding material to said shaping space, the fiber of said connection bands 40 and 50 varies, or does not slacken.

[0023] The shaping space of the primary molding die 3 extends between the circular base shaping space 101 which surrounds each connector link 30, and said base shaping space 101,101 which adjoins a circumferential direction, and consists of periphery Division for Interlibrary Services shaping space 102 which surrounds the first connection band 40 or the second connection band 50, and inner circumference Division for Interlibrary Services shaping space 103. Moreover, hollow 102a dented to the periphery side is formed in the extended direction mid-position in said periphery Division for Interlibrary Services shaping space 102, and hollow 103a dented to the inner circumference side is formed in the extended direction mid-position in said inner circumference Division for Interlibrary Services shaping space 103.

[0024] Drawing 3 shows primary Plastic solid 1A fabricated by the above-mentioned primary molding die 3. This primary Plastic solid 1A each connector link 30 and the first and second connection bands 40 and 50 It is the structure covered with the shaping space of the primary molding die 3, and

corresponding elastic body inner layer section 60A of a configuration. Said elastic body inner layer section 60A Between base 61A of Rokkasho which is surrounding the periphery side of each connector link 30, and said bases 61A and 61A which adjoin a circumferential direction is extended. It consists of a periphery which is surrounding the perimeter of the first connection band 40 or the second connection band 50, and the inner circumference Division for Interlibrary Services 62A and 63A. To each periphery Division for Interlibrary Services 62A Corresponding to hollow 102a in the primary molding die 3, the heights 65 which the heights 64 projected to the periphery side projected to the inner circumference side to each inner circumference Division for Interlibrary Services 63A again corresponding to hollow 103a in the primary molding die 3 are formed, respectively.

[0025] As shown in drawing 4 , with the connector links 30 and 30 in the flexible coupling 1 as a product shown in drawing 5 , and -- (the driving-side connection child 10 and follower side connection child 20) next, on the periphery of the same pitch  $\phi 1$  Extrapolation immobilization of each connector links 30 and 30 of above-mentioned primary Plastic solid 1A and -- is carried out, and said primary Plastic solid 1A is included in the fixed shafts 4 and 4 and -- which have been arranged at intervals of the phase of 60 degrees in this condition in the shaping space of the secondary molding die 5.

[0026] The shaping space of the metal mold 5 for secondary forming extends between the circular base shaping space 201 which surrounds each base 61A of elastic body inner layer section 60A in primary Plastic solid 1A, and said base shaping space 201,201 which adjoins a circumferential direction in the shape of a straight line, and consists of periphery Division for Interlibrary Services shaping space 202 which surrounds the periphery in primary Plastic solid 1A, and the inner circumference Division for Interlibrary Services 62A and 63A, and inner circumference Division for Interlibrary Services shaping space 203. Moreover, the clearance G between the inside of the base shaping space 201 in said shaping space and said base 61A is smaller than the direction height of a path of the heights 64 and 65 formed in said periphery and the inner circumference Division for Interlibrary Services 62A and 63a.

[0027] The fixed shafts 4 and 4 which are fixing each connector link 30 in primary Plastic solid 1A, and -- as mentioned above, a pitch  $\phi 1$  Since the connector links 30 and 30 at the time of shaping by the primary molding die 3 and -- are smaller than a pitch  $\phi 2$ , predetermined slack can be given to periphery Division for Interlibrary Services which spacing is reduced and is prolonged in the meantime 62of fixed shafts 4 and 4, connector link [ which were fixed to -- ] 30 and 30, -- A, and inner circumference Division for Interlibrary Services 63A. On the other hand, the height of the heights 64 and 65 formed in elastic body inner layer section 60A in said primary Plastic solid 1A Since it is larger than the clearance G between the inside of the base shaping space 201 in the shaping space of the metal mold 5 for secondary forming, and base 61A in said primary Plastic solid 1A, So that said each heights 64 may contact the inside of the periphery Division for Interlibrary Services shaping space 202 and may make the pars intermedia of said periphery Division for Interlibrary Services 62A unevenly distributed to the inner circumference side of the periphery Division for Interlibrary Services shaping space 202 Push, Moreover, said each heights 65 contact the inside of the inner circumference Division for Interlibrary Services shaping space 203, and it pushes so that the pars intermedia of inner circumference Division for Interlibrary Services 63A may be made unevenly distributed to the periphery side of the inner circumference Division for Interlibrary Services shaping space 203.

[0028] For this reason, the interstitial segment of the first connection band 40 passing through the inside of the periphery Division for Interlibrary Services shaping space 202 of shaping space or the second connection band 50, and the first connection band 40 or the second connection band 50 passing through the inside of the inner circumference Division for Interlibrary Services shaping space 203 slackens with periphery Division for Interlibrary Services 62A and inner circumference Division for Interlibrary Services 63A in elastic body inner layer section 60A so that it may approach mutually in the direction of a path.

[0029] next, secondary forming which set primary Plastic solid 1A as mentioned above -- public funds -- vulcanization shaping of the elastic body outer layer section (illustration abbreviation) of necessary thickness is carried out in one by filling up the shaping space of a mold 5 with an elastomer molding material at the periphery of said primary Plastic solid 1A. At this time, the first connection band 40 and



the second connection band 50 which consist of multilayer wire rods 41 and 51 Since it is covered with the elastomer (periphery Division for Interlibrary Services 62A, inner circumference Division for Interlibrary Services 63A) restoration of said elastomer molding material -- the fiber consistency of said connection bands 40 and 50 -- Bala -- since it is sufficient just, and it does not carry out and the amount of slack of said connection bands 40 and 50 is prescribed by the heights 64 and 65 in primary Plastic solid 1A, dispersion in the amount of slack is not produced, either.

[0030] After shaping by the metal mold 5 for secondary forming attaches the driving-side connection child 10 and the follower side connection child 20 in connector links 30 and 30 and -- by turns, and serves as the flexible coupling 1 of the structure shown to drawing 5 by this.

[0031] In addition, this invention is not restrictively interpreted according to the operation gestalt of illustration. For example, arrangement spacing does not necessarily need to be circumferencial direction 6 grade \*\* like illustration, and is a thing of connector links 30 and 30 and -- determined corresponding to the specification of axis end York for wearing etc.

[0032]

[Effect of the Invention] After fabricating the primary Plastic solid which covered the connection band according to the manufacture approach of the flexible coupling concerning this invention, where slack is given to said connection band between each connector link Since it is what manufactures the flexible coupling which has a two-step property by carrying out secondary forming of the elastic body, In spite of giving slack to a connection band between the connector links which adjoin a circumferencial direction, dispersion in the fiber consistency of a connection band or the amount of slack does not occur by restoration of the molding material into metal mold at the time of shaping of an elastic body. This sake, An input torque does not become excessive with some connection bands, and the flexible coupling excellent in endurance can be offered. And since the member for giving slack to a connection band is unnecessary, components mark do not increase but the fall of the endurance resulting from said member can also be prevented.

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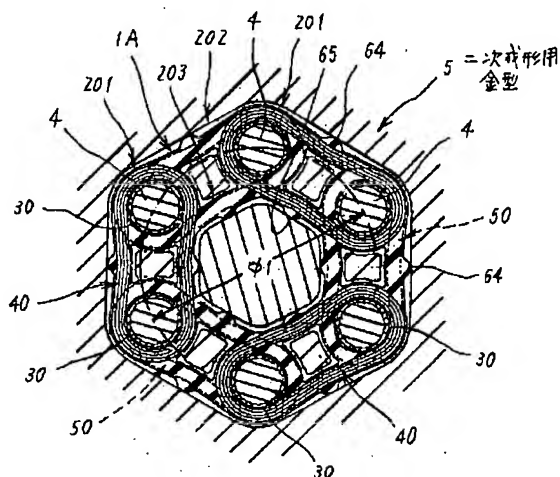
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(54)【発明の名称】 フレキシブルカップリングの製造方法

(57)【要約】

【課題】 捩り変位量が小さい場合の緩衝性や吸振性及びトルク伝達力の双方を満足し、耐久性に優れたフレキシブルカップリングを提供する。

【解決手段】 偶数個の連結環30を円周方向所定間隔で配置し、円周方向に隣り合う連結環30,30を、ループ状に巻き掛けた第一及び第二連結帯40,50で円周方向交互に連結し、一次成形用金型3内にセットして、前記第一及び第二連結帯40,50を弾性体内層部で被覆した一次成形体1Aを成形し、この一次成形体1Aを、連結環30,30のピッチφ1を一次成形用金型内での連結環30,30のピッチよりも小さくし、凸部64,65によって、第一及び第二連結帯40,50に前記各連結環30,30の間で弛みを与えた状態で二次成形用金型5内にセットし、この一次成形体1Aの外周に所要の厚みの弾性体外層部を成形する。



## 【特許請求の範囲】

【請求項1】 偶数個の連結環(30)を円周方向所定間隔で配置し、円周方向に隣り合う前記連結環(30, 30)を、ループ状に巻き掛けた第一及び第二連結帯(40, 50)で円周方向交互に連結し、一次成形用金型(3)内にセットして、前記第一及び第二連結帯(40, 50)を弾性体内層部(60A)で被覆した一次成形体(1A)を成形し、前記弾性体内層部(60A)を介して前記第一及び第二連結帯(40, 50)に前記各連結環(30, 30)の間で弛みを与えた状態で、前記一次成形体(1A)を二次成形用金型(5)内にセットして、この一次成形体(1A)の外周に所要の厚みの弾性体外層部を成形することを特徴とするフレキシブルカップリングの製造方法。

## 【発明の詳細な説明】

## 【0001】

【発明の属する技術分野】本発明は、駆動側回転軸と従動側回転軸との軸端間を弾性的に連結するフレキシブルカップリングの製造方法に関するものである。

【0002】この種のフレキシブルカップリングとしては、複数の駆動側連結環及び従動側連結環が円周方向交互に配置され、円周方向に隣り合う駆動側連結環及び従動側連結環が、ある程度弛みをもった状態で繊維をループ状に巻き掛けた連結帯によって連結され、これら連結環及び連結帯が、ゴムに埋設された構造としたものがある。そしてその典型的な従来技術が、例えば特開昭62-292924号公報あるいは特許公報第2773348号に開示されている。

【0003】上記フレキシブルカップリングは、各駆動側連結環が、駆動側回転軸の軸端に円周方向等間隔で取り付けられる一方、各従動側連結環が、従動側回転軸の軸端に円周方向等間隔で取り付けられ、駆動側から従動側への動力伝達を行うもので、回転トルクの入力時に、駆動側連結環と従動側連結環の間で連結帯の弛みが解消されるまでは、振り剛性が小さく維持されるので優れた吸振効果を発揮し、前記連結帯が直線状に引き伸ばされると、振り剛性が高くなるので大きなトルク伝達力を発揮するといった、二段特性を有する。

## 【0004】

【発明が解決しようとする課題】しかしながら、振り特性を二段特性化するために、隣り合う駆動側連結環と従動側連結環の間で連結帯に弛みを与えると、ゴムの成形時に、金型内への成形材料の充填によって、前記連結帯の繊維密度がばらついたり、弛み量の相違を生じやすい。このため、各連結帯が入力トルクを均一に分担できなくなり、すなわち一部の連結帯で入力トルクが過大になって、耐久性が低下するおそれがある。

【0005】また、上記従来技術によれば、連結帯に弛みを与えるための挿入部材を必要としているので、部品点数が多くなるばかりでなく、前記挿入部材が前記連結

帯に接触しているため、摩擦によって連結帯の摩耗が促進され、早期に破損に到るおそれがある。しかも、トルク入力によって振り角が大きくなると、前記挿入部材が連結帯から外れやすくなったり、この挿入部材の周囲でゴムに亀裂が生じるおそれも指摘される。

【0006】本発明は、上記のような問題に鑑みてなされたもので、その主な技術的課題とするところは、トルクの初期入力時の吸振性及び緩衝性や、トルク伝達力の双方を満足し、耐久性に優れたフレキシブルカップリングを提供することにある。

## 【0007】

【課題を解決するための手段】上述した技術的課題を有効に解決するため、本発明に係るフレキシブルカップリングの製造方法は、偶数個の連結環を円周方向所定間隔で配置し、円周方向に隣り合う前記連結環を、ループ状に巻き掛けた第一及び第二連結帯で円周方向交互に連結し、一次成形用金型内にセットして、前記第一及び第二連結帯を弾性体内層部で被覆した一次成形体を成形し、前記弾性体内層部を介して前記第一及び第二連結帯に前記各連結環の間で弛みを与えた状態で、前記一次成形体を二次成形用金型内にセットして、この一次成形体の外周に所要の厚みの弾性体外層部を成形するものである。

## 【0008】

【発明の実施の形態】図1乃至図3は、本発明に係るフレキシブルカップリングの製造方法の好ましい実施の形態を示すものである。なお、以下の説明において「円周方向」とはフレキシブルカップリングの軸心を中心とする円周の方向のことである。

【0009】この製造方法において製造対象となるフレキシブルカップリングは、図5に示されるような構造を有する。すなわち、このフレキシブルカップリング1は、円周方向120°間隔で三個配置された駆動側接続子10と、この駆動側接続子10とは60°異なる位相で、円周方向120°間隔で三個配置された従動側接続子20と、これら各接続子10, 20の外周に装着された連結環30と、円周方向に隣り合う駆動側接続子10の外周の連結環30及び従動側接続子20の外周の連結環30に跨がって、円周方向交互に巻き掛けられた第一及び第二連結帯40, 50と、前記各連結環30及び各連結帯40, 50を被覆した状態に加硫成形されたエラストマからなる弾性体60とを備える。

【0010】駆動側接続子10及び従動側接続子20は、円筒状の金属部材からなるものであって、その軸心が当該フレキシブルカップリング1の軸心と平行になるように配置されている。また、連結環30は、図2に示されるように、前記駆動側接続子10又は従動側接続子20が圧入嵌着される金属製スリーブ31及びその軸方向両端部の外周面に固定された断面略U字形の一対の金属製カラー32, 33からなる。

【0011】第一及び第二連結帯40, 50は、図2に

示されるように、例えばポリエステル等の所要の引張弾性を有する高分子材料からなる線材41、51を、多層状に巻回したものである。そしてこのうち第一連結帯40は、駆動側接続子10に装着された連結環30のスリーブ31の外周におけるカラー32、33の間の部分と、前記駆動側接続子10と円周方向に隣接する従動側接続子20に装着された連結環30のスリーブ31の外周におけるカラー32、33の間の部分とに跨がってループ状に巻き掛けられている。また、第二連結帯50は、従動側接続子20に装着された連結環30のカラー32、33内と、前記従動側接続子20と円周方向に隣接する駆動側接続子10に装着された連結環30におけるカラー32、33内とに跨がってループ状に巻き掛けられている。

【0012】すなわち、各駆動側接続子10と各従動側接続子20は、互いに60°の間隔で交互に配置され、連結環30、30、…の軸方向中間に巻き掛けられた第一連結帯40と、前記連結環30、30、…の軸方向両端近傍に巻き掛けられた第二連結帯50とによって、円周方向交互に連結されている。

【0013】弾性体60は、連結環30、30、…の周囲及びその間を延びる第一及び第二連結帯40、50の周囲を包み込むように成形されている。詳しくは、各連結環30の外周側を包囲している六ヶ所の基部61と、円周方向に隣り合う前記基部61、61の間を直線状に延びて、第一連結帯40又は第二連結帯50の周囲を包囲している外周及び内周連絡部62、63からなり、これらの間はそれぞれ窓部60aとなっている。

【0014】また、第一及び第二連結帯40、50は、弾性体60における外周連絡部62及び内周連絡部63の内部で、窓部60a側へ偏在するように弛んだ形状に延びている。すなわち、外周連絡部62内を通る第一連結帯40の中間部分と、内周連絡部63内を通る第一連結帯40の中間部分との距離L1は、連結環30におけるスリーブ31の第一連結帯巻き径d1（図2参照）より小さく、同様に、外周連絡部62内を通る第二連結帯50の中間部分と、内周連絡部63内を通る第二連結帯50の中間部分との距離L2は、連結環30におけるカラー32、33の第二連結帯巻き径d2（図2参照）より小さくなっている。

【0015】上記構成を備えるフレキシブルカップリング1は、各駆動側接続子10が、それぞれに挿通したボルト（図示省略）によって、駆動側回転軸の軸端のヨークに円周方向120°間隔で取り付けられる一方、各従動側接続子20が、それぞれに挿通したボルト（図示省略）によって、前記駆動側回転軸の軸端と対向する従動側回転軸の軸端のヨークに、円周方向120°間隔で取り付けられる。これによって、駆動側回転軸の回転を第一連結帯40又は第二連結帯50を介して従動側回転軸へ伝達すると共に、前記第一及び第二連結帯40、50

と弾性体60の変形特性によって、駆動側回転軸と従動側回転軸の軸心の方向が異なる状態での回転伝達を許容し、かつ前記両軸間で振動を吸収するものである。

【0016】詳しくは、トルクの入力によって、駆動側回転軸と従動側回転軸が相対的に振り変位すると、駆動側接続子10と従動側接続子20が相対的に離間される部分では、第一連結帯40又は第二連結帯50が、連結環30、30間での弛み形状から引き伸ばされる。そして、第一連結帯40又は第二連結帯50が直線状に引き伸ばされるまでの過程では、これに一体化された弾性体60の外周連絡部62が外径方向へ、内周連絡部63が内径方向へ弾性的に曲げ変形を受けることになるため、適当な振りばね性を発揮し、これによって、有効な緩衝機能及び吸振機能を奏する。

【0017】また、駆動側回転軸と従動側回転軸との振り変位量が所定以上に大きくなることによって、駆動側接続子10と従動側接続子20が相対的に離間される部分での第一連結帯40又は第二連結帯50の弛みが解消され、完全に直線状に引き伸ばされた状態になると、この時点から前記第一連結帯40又は第二連結帯50の引張弾性によって振りばね定数が高まる。このため、駆動側接続子10と従動側接続子20との間の過大な振り変位が抑制され、確実なトルク伝達が行われる。

【0018】図6は、図5に示されるフレキシブルカップリング1について、振りばね特性を測定した特性線図を示すものである。この図から明らかなように、第一連結帯40又は第二連結帯50が直線状に引き伸ばされるまでは、振りばね定数の低い吸振領域αとなり、それよりも振り角度の大きい領域では、振りばね定数が高いトルク伝達領域βとなっている。これに対し、連結帯40、50に弛みのない構造のフレキシブルカップリングは、図7に示されるように、振り初期から振りばね定数が高く、顕著な吸振領域αが存在しない。前記吸振領域αは、次式で表すことができる。

【数1】

$$\alpha \cong \left( \frac{\phi_2 - \phi_1}{\phi_1} \right) \times 2^\circ$$

ここで、

φ1；フレキシブルカップリング1における連結環30、30、…のピッチ（図5参照）

φ2；後述する一次成形時における連結環30、30、…のピッチ（図1参照）

【0019】また、このフレキシブルカップリング1には、第一及び第二連結帯40、50に弛みを与えるための挿入部材が存在しないため、部品点数が多くならず、前記部材との摩擦による第一及び第二連結帯40、50の摩耗や、振り角の増大時に前記挿入部材に起因する弾性体60の亀裂の発生等も生じ得ない。

【0020】上記構成のフレキシブルカップリング1は、以下に述べる方法によって製造することができる。

【0021】まず、図1に示されるように、ピッチ $\phi 2$ の円周上に $60^\circ$ の位相間隔で配置した固定軸2, 2, …に、それぞれ連結環30, 30, …を外挿固定し、円周方向に隣り合う連結環30, 30, …に、第一連結帯40及び第二連結帯50を交互に巻き掛ける。なお、前記固定軸2, 2, …のピッチ $\phi 2$ は、図5に示される製品としてのフレキシブルカップリング1における連結環30, 30, …(駆動側接続子10及び従動側接続子20)のピッチ $\phi 1$ よりも若干大きく設定されている。また、先に説明した図2に示されるように、第一連結帯40は、連結環30におけるカラー32, 33の間の部分に巻き掛けられ、第二連結帯50は、両側のカラー32, 33に巻き掛けられる。

【0022】次に、上述の状態、連結環30, 30, …と第一及び第二連結帯40, 50の結束物を一次成形用金型3の成形空間に組み込んでから、エラストマ成形材料を充填して加硫成形する。このとき、前記第一連結帯40及び第二連結帯50は、隣り合う連結環30, 30間に、所定の張力を与えた状態で巻き掛けられているため、前記成形空間へのエラストマ成形材料の充填によって、前記連結帯40, 50の繊維がばらついたり、弛んだりすることがない。

【0023】一次成形用金型3の成形空間は、各連結環30を包囲する円形の基部成形空間101と、円周方向に隣り合う前記基部成形空間101, 101間を延びて、第一連結帯40又は第二連結帯50を包囲する外周連絡部成形空間102及び内周連絡部成形空間103からなる。また、前記外周連絡部成形空間102における延長方向中間位置には、外周側へ凹んだ凹所102aが形成されており、前記内周連絡部成形空間103における延長方向中間位置には、内周側へ凹んだ凹所103aが形成されている。

【0024】図3は、上述の一次成形用金型3によって成形された一次成形体1Aを示すものである。この一次成形体1Aは、各連結環30と、第一及び第二連結帯40, 50を、一次成形用金型3の成形空間と対応する形状の弾性体内層部60Aで被覆した構造であって、前記弾性体内層部60Aは、各連結環30の外周側を包囲している六ヶ所の基部61Aと、円周方向に隣り合う前記基部61A, 61Aの間を延びて、第一連結帯40又は第二連結帯50の周囲を包囲している外周及び内周連絡部62A, 63Aからなり、各外周連絡部62Aには、一次成形用金型3における凹所102aと対応して、外周側へ突出した凸部64が、また、各内周連絡部63Aには、一次成形用金型3における凹所103aと対応して、内周側へ突出した凸部65が、それぞれ形成されている。

【0025】次に、図4に示されるように、図5に示される製品としてのフレキシブルカップリング1における連結環30, 30, …(駆動側接続子10及び従動側接

続子20)と同一ピッチ $\phi 1$ の円周上に、 $60^\circ$ の位相間隔で配置した固定軸4, 4, …に、上述の一次成形体1Aの各連結環30, 30, …を外挿固定し、この状態で、前記一次成形体1Aを二次成形用金型5の成形空間に組み込む。

【0026】二次成形用金型5の成形空間は、一次成形体1Aにおける弾性体内層部60Aの各基部61Aを包囲する円形の基部成形空間201と、円周方向に隣り合う前記基部成形空間201, 201間を直線状に延びて、一次成形体1Aにおける外周及び内周連絡部62A, 63Aを包囲する外周連絡部成形空間202及び内周連絡部成形空間203からなる。また、前記成形空間における基部成形空間201の内面と前記基部61Aとの隙間Gは、前記外周及び内周連絡部62A, 63aに形成された凸部64, 65の径方向高さよりも小さいものとなっている。

【0027】上述のように、一次成形体1Aにおける各連結環30を固定している固定軸4, 4, …のピッチ $\phi 1$ は、一次成形用金型3による成形時の連結環30, 30, …のピッチ $\phi 2$ より小さいため、固定軸4, 4, …に固定された連結環30, 30, …の間隔が縮小され、その間を延びる外周連絡部62A及び内周連絡部63Aに所定の弛みを与えることができる。一方、前記一次成形体1Aにおける弾性体内層部60Aに形成された凸部64, 65の高さは、二次成形用金型5の成形空間における基部成形空間201の内面と、前記一次成形体1Aにおける基部61Aとの隙間Gより大きいため、前記各凸部64が外周連絡部成形空間202の内面に当接して、前記外周連絡部62Aの中間部を外周連絡部成形空間202の内周側へ偏在させるように押し、また、前記各凸部65が内周連絡部成形空間203の内面に当接して、内周連絡部63Aの中間部を、内周連絡部成形空間203の外周側へ偏在させるように押す。

【0028】このため、成形空間の外周連絡部成形空間202内を通る第一連結帯40又は第二連結帯50の中間部分と、内周連絡部成形空間203内を通る第一連結帯40又は第二連結帯50が、径方向へ互いに近接するように、弾性体内層部60Aにおける外周連絡部62A及び内周連絡部63Aと共に弛む。

【0029】次に、上述のように一次成形体1Aをセットした二次成形用金型5の成形空間に、エラストマ成形材料を充填することによって、前記一次成形体1Aの外周に所要の厚みの弾性体外層部(図示省略)を一体的に加硫成形する。このとき、多層の線材41, 51からなる第一連結帯40及び第二連結帯50は、エラストマ(外周連絡部62A, 内周連絡部63A)で被覆されているので、前記エラストマ成形材料の充填によって、前記連結帯40, 50の繊維密度がバラついたりすることがなく、前記連結帯40, 50の弛み量は、一次成形体1Aにおける凸部64, 65によって規定されるので、

弛み量のばらつきも生じない。

【0030】二次成形用金型5による成形後は、連結環30、30、…に駆動側接続子10及び従動側接続子20を交互に嵌着し、これによって図5に示される構造のフレキシブルカップリング1となる。

【0031】なお、本発明は、図示の実施形態によって限定的に解釈されるものではない。例えば、連結環30、30、…の配置間隔は、必ずしも図示のように円周方向6等配である必要はなく、装着対象の軸端ヨークの仕様等に対応して決定されるものである。

【0032】

【発明の効果】本発明に係るフレキシブルカップリングの製造方法によれば、連結帯を被覆した一次成形体を成形してから、前記連結帯に各連結環の間で弛みを与えた状態で、弾性体を二次成形することによって、二段特性を有するフレキシブルカップリングを製造するものであるため、円周方向に隣り合う連結環の間で連結帯に弛みを与えるにも拘らず、弾性体の成形時に、金型内への成形材料の充填によって、連結帯の繊維密度や弛み量のばらつきが発生せず、このため、一部の連結帯で入力トルクが過大になることがなく、耐久性に優れたフレキシブルカップリングを提供することができる。しかも、連結帯に弛みを与えるための部材が不要であるため、部品点数が多くなり、前記部材に起因する耐久性の低下も防止することができる。

【図面の簡単な説明】

【図1】本発明に係るフレキシブルカップリングの製造方法の好ましい実施の形態における一次成形体の成形工程を示す説明図である。

【図2】上記製造方法において第一及び第二連結帯が巻き掛けられた連結環を、その内周の接続子と共に、軸心を通る平面で切断して示す部分断面図である。

【図3】上記実施形態の製造方法によって得られた一次成形体を示す、一部断面を表す外観図である。

【図4】上記製造方法における二次成形体の成形工程を示す説明図である。

【図5】上記製造方法によって製造されたフレキシブルカップリングを示す、一部断面を表す外観図である。

【図6】上記フレキシブルカップリングの振りばね特性を示す特性線図である。

【図7】連結帯に弛みのない構造とした比較例としてのフレキシブルカップリングの振りばね特性を示す特性線図である。

【符号の説明】

1 フレキシブルカップリング

1A 一次成形体

2, 4 固定軸

3 一次成形用金型

5 二次成形用金型

10 駆動側接続子

20 従動側接続子

30 連結環

31 スリーブ

32, 33 カラー

40 第一連結帯

41, 51 線材

50 第二連結帯

60 弾性体

60A 弾性体内層部

60a 窓部

61, 61A 基部

62, 62A 外周連絡部

63, 63A 内周連絡部

64, 65 凸部

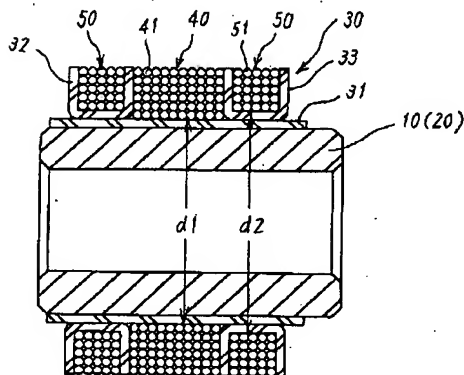
101, 201 基部成形空間

102, 202 外周連絡部成形空間

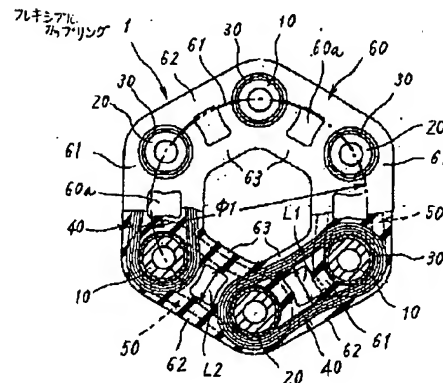
102a, 103a 凹所

103, 203 内周連絡部成形空間

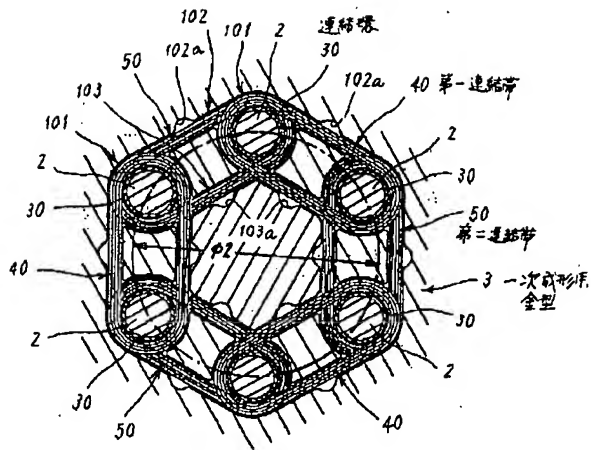
【図2】



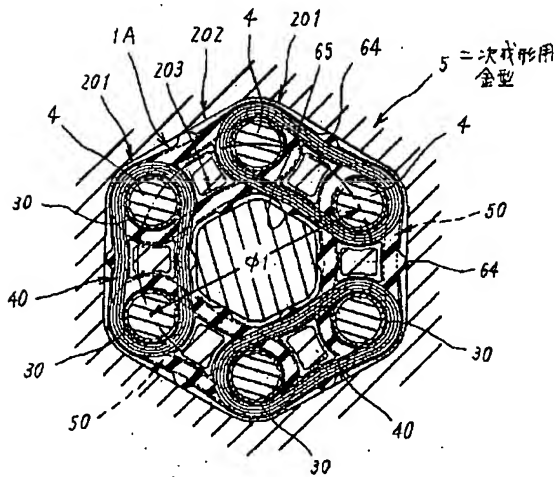
【図5】



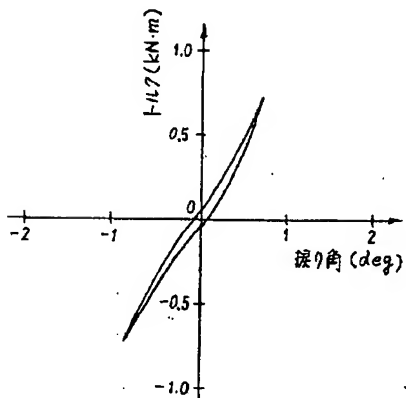
【図1】



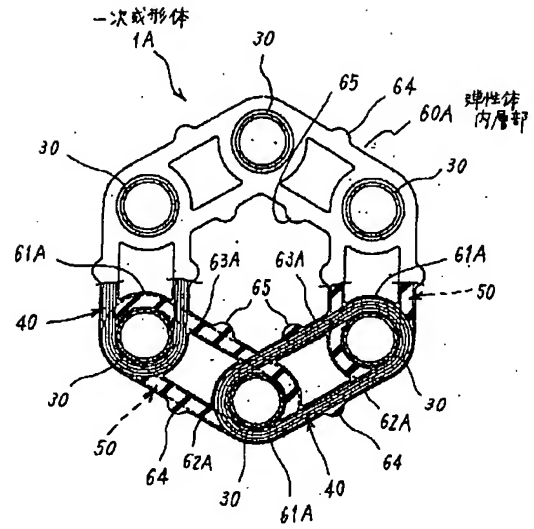
【図4】



【図7】



【図3】



【図6】

